

REMARKS

Claims 1-18 remain pending in the application. Claims 1, 7, and 13 have been amended for clarification:

Claims 1-2, 5-8, 11-14, 17-18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Krishna (U.S Patent 6,138,111) in view of Iyer et al (US patent 5,345,585).

As for Claim 1, 7 and 13, Office Action stated that Krishna discloses the recited limitations as follows:

'a computer-based method for determining the optimum join sequence for processing a query having a plurality of tables from a relational database stored in an electronic storage device having a database management system' *as the process of a join order optimization for a multiple join queries in a relational database management system* [See col. 1, lines 5-6], the method comprising the steps of:

'a first pass for determining an optimum join sequence for joining the plurality of tables from the query' *as the calculating an optimal order for join of tables in a multiple join query* [See Fig. 1, col. 3, lines 24-26, 31-32];

'a second pass for using the optimum join sequence for creating a lowest cost access path plan for processing the query' *as a join order selected among other possible join orders, wherein the selected join order has the smallest sigma (i.e., lowest cost) and the optimal access path to perform the join query* [See Fig. 2, col. 3, lines 44-50].

As shown in claims 1, 7 and 13, as amended, the present invention is directed to a system and a computer-based method for determining the optimum join sequence for processing a query having a plurality of tables from a relational database stored in an electronic storage device having a database management system, the method comprising the steps of:

(a) a first pass using simulation, miniplans and composite tables for determining an optimum join sequence for joining the plurality of tables from the query; and

(b) a second pass for using the optimum join sequence for creating a lowest cost access path plan for processing the query.

Claim 2 is directed to the method according to claim 1, wherein the first pass performing successive steps until creation of a simulated composite table having all tables from the query, wherein each said step:

creating a set of miniplans for simulating all possible joins of a predetermined subset of the query tables; and

using a cost model calculations for estimating and saving the least expensive join from said set of joins, thereby determining the optimum join sequence.

Independent claims 1, 7 and 13 are hereby amended to clarify that the present invention uses simulation, miniplans and composite tables in determination of the optimum join sequence, used for the access path plan for processing the query. Thus, the present invention uses a **two pass process** for creating a lowest cost access path plan for processing the query. As can be see throughout the Specification (starting on page 6) the present invention uses simulation and creates a set of **miniplans for simulating all possible joins and simulated composite tables**.

Krishna reference, however, does not teach use of a two pass process for creating a lowest cost access path plan, does not use simulation, and does not create miniplans and composite tables. It is true that Krishna reference uses a lowest cost, but Krishna reference calculates a sigma metric as a cardinality of each join by summing table cardinality estimates, preferably determined by a graph or retrieving a pre-computed value, as can be seen in col. 3, li. 46, li. 59-67. It merits the candidate join orders as a whole (Abstract) and not for partial miniplans. Cited Fig. 1 shows a hardware and software configuration and cited col. 3-4 sections and Fig. 2 explicitly show obtainment of cardinality and calculation of sigma, none of which can invalidate the claims of the present invention. Fig. 3-5 show graph formation and join cardinality estimation, none of which can invalidate the claims of the present invention.

Krishna reference thus teaches away from the present invention because it is directed to a calculations of table cardinality whereas the present invention creates a set of miniplans for simulating all possible joins and composite tables.

Therefore, Krishna reference clearly does not teach the features of the present invention, recited in the claims, as amended, and throughout the Specification, which are not shown in the Krishna reference. Cited reference does not show any features of the present invention, operating in the same way and for the same purpose. Thus, the reference is from a different art field.

To establish prima facie case of obviousness under 35 U.S.C. 103 (a):

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the **subject matter as a whole would have been obvious** at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

According to this quotation "the subject matter as a whole would have been obvious...." However, neither one of cited references or their combination teaches a two pass method, miniplans, composite table and use of simulation for their creation, as claimed in independent claims 1, 7 and 13 of the present invention.

Therefore, it is clear that the standard under 35 USC 103 has not been met for the claimed invention, because the cited reference Krishna does not have any and all elements of independent claims, as amended, is from a different field, has different components, works in a different mode of use and produces different results. Thus, independent claims 1, 7, and 13 (as amended) and all claims dependent upon them in the present invention recite novel structure and therefore distinguish over the cited prior art, Krishna, and are not made obvious by it under 35 U.S.C. 103(a).

It is noted with appreciation that Office Action held that Krishna does not explicitly teach using simulation. However, it held that Iyer teaches using simulation for determining an optimum join sequence (col. 5, lines 12-27) and that, thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references to use a simulation for determining an optimum join sequence as disclosed by Iyer, because this would allow users of Krishna's system to perform all possible join plan (join order) having the

minimal cost is the optimal solution plan, so that the optimal solution plan (i.e., a low cost join plan) can be performed in a relatively short period of time, because a good join plan enables a query to be processed and data retrieved in an effective manner so as not require excessive processing time, as suggested by Iyer (col. 7, lines 52-58, col. 6, lines 60-67).

Iyer, however, does not teach use of simulation either. In cited col. 6-7 sections, Iyer mentions prior art **Simulated Annealing** which has nothing to do with simulation but **transformations** with a probability threshold, in a **single run** process. Cited Microsoft dictionary does not define this term. However, the web site Dictionary.com gives The Free On-line Dictionary of Computing definition for Simulated Annealing as: "A technique which can be applied to any minimisation or learning process based on successive update steps (either random or deterministic) where the update step length is proportional to an arbitrary set parameter which can play the role of a temperature. Then, in analogy with the annealing of metals, the temperature is made high in the early stages of the process for faster minimisation or learning, then is reduced for greater stability." Webster dictionary defines annealing as softening and toughening".

Therefore, Iyer does not teach using simulation, miniplans and composite tables for determining an optimum join sequence, as claimed in the present invention.

As stated in MPEP Sec. 706.02(j), 35 U.S.C. 103 authorizes a rejection where, to meet the claim, it is necessary to modify a single reference or to combine it with one or more other references. After indicating that the rejection is under 35 U.S.C. 103, the examiner **should** set forth in the Office action:

- (A) the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate,
- (B) the difference or differences in the claim over the applied reference(s),
- (C) the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter, and
- (D) an explanation why one of ordinary skill in the art at the time the invention was made would have been motivated to make the proposed modification.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success

must both be found in the prior art and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). See MPEP Sec. 2143 - 2143.03 for decisions pertinent to each of these criteria.

The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). See MPEP Sec. 2144 - 2144.09 for examples of reasoning supporting obviousness rejections.

As shown by the Applicant, the teachings of the referenced prior art are not relevant to the claimed invention, the proposed modifications of the applied reference(s) necessary to arrive at the claimed subject matter are not shown, and an explanation about why one of ordinary skill in the art at the time the invention was made would have been motivated to make the proposed modification was not given.

Further, each cited reference is individually complete and they do not suggest a combination or modification and are impossible to combine. Case *Amgen, Inc. v. Chugai Pharmaceutical Co.*, 927 F.2d 1200, 18 USPQ2d 1016 (Fed. Cir. 1991) is on point as is the case *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984), which held that where there is no technological motivation for a modification or if a proposed modification of reference would destroy intent, purpose or function of the reference, the prima facie case of obviousness is not properly established. This law was not followed in the Office Actions either.

The Examiner has not established a prima facie case of obviousness because the three basic criteria stated above, which must be met, were not met because she did not point out: to any suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings, a reasonable expectation of success was not shown (and is impossible) and that the prior art reference(s), which must teach or suggest all the claim limitations, do so here, which they do not. Furthermore, the Examiner did not satisfy the initial burden to provide some suggestion in the references of the desirability of doing what the inventor has done, because to support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must

present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

Therefore, these references cannot be used to invalidate independent claims 1, 7, and 13 and their dependent claims. Because none of the referenced prior art teaches elements (a) to (b) of claims 1, 7 and 13, which are the main steps of the present invention, their combination is not a valid reason for rejection of these independent claims and claims dependent thereof. Therefore, each cited reference, by itself or in combination, cannot be used to invalidate claims 1, 7 and 13 because they fail to teach any and all the steps of these claims and they are valid.

As for **Claims 2, 8 and 14**, Office Action stated that Krishna teaches 'wherein the first pass performing successive steps until creation of a **simulated composite table** having all tables from the query' *as a joining of a plurality of tables R, S, and T from the query* [See col. 3, lines 31-32]. *There are two possible join orders for the tables R, S, and T. The first (1) possible join order is join tables R and S, then join the result with table T, the second (2) possible join order is join tables S and T, then join the result with table R* [See col. 3, lines 33-35], 'wherein each said step:

creating a set of **miniplans** for **simulating all possible joins of a predetermined subset of the query tables**' *as after joining the two possible join orders, the calculation of the total query for the join order (1) is $80(20+60)$ and the join order (2) is $560(500+60)$ are created* [See col. 3, lines 35-41]; and

'using a cost model calculations for estimating and saving the least expensive join from said set of joins, thereby determining the optimum join sequence' *as the cost estimate calculations for the join order (1) is 80 and the join order (2) is 560. Thus, the join order (1) is indicated the least expensive join order from the set of join orders* [see col. 3, lines 52-55].

Cited Italic quotes from the Krishna reference do not even mention **first pass**, performing **successive steps**, creation of a **simulated composite table**, creation of **miniplans** for simulating all possible joins, etc. Cited Italic quotes show how many tuples are created when a join is performed in different ways and do not teach process of join ordering. They neither show teachings of the present invention nor the reference, just give a justification for join ordering.

This is clearly seen in Col. 3, li. 30-43 which start with "Consider" and end with "the choice of join order can be significant".

Office Action fails to quote, however, the teachings of Krishna shown in col. 3, li. 44-67, as argued by the Applicant above, which clearly show that Krishna reference does not teach use of a two pass process for creating a lowest cost access path plan, does not use simulation, and does not create miniplans and composite tables. It is true that Krishna reference uses a lowest cost, but Krishna reference calculates sigma metric as a cardinality of each join by summing table cardinality estimates, preferably determined by a graph or retrieving a pre-computed value, as can be seen in col. 3, li. 46, li. 59-67.

Therefore, the reference cannot be used to reject these claims. Thus, dependent claims 2, 8, and 14 and all claims dependent upon them in the present invention recite novel and nonobvious structure and therefore distinguish over the cited prior art, Krishna, and are not obvious under 35 U.S.C. 103(a).

As for **Claims 5, 11 and 17**, Office Action stated that Krishna teaches 'wherein the second pass performing successive steps until creation of a **simulated composite table** having all tables from the query, wherein each said step being performed in the optimum join sequence' *as if the join orders remain to be examined, the process repeats for the next possible join order. A join order with the smallest value is used to perform the join query* [See col. 4, lines 4-7].

Office Action failed to cite properly col. 4, lines 4-7 of Krishna, which clearly states verbatim: *A join order with the smallest value **Of Sigma** is used to perform the join query.* This clearly shows that Krishna reference does not teach use of a two pass process for creating a lowest cost access path plan, does not use simulation, and does not create miniplans and composite tables, but that Krishna reference calculates sigma metric as a cardinality of each join by summing table cardinality estimates, preferably determined by a graph or retrieving a pre-computed value, as can be seen in col. 3, li. 46, li. 59-67.

Further, Office Action failed to cite fully the definition of a process which *repeats for the next possible join order*. The process is described in col. 3, li. 46, li. 59-67 of Krishna as: calculation of sigma metric as a cardinality of each join by summing table cardinality estimates, preferably determined by a graph or retrieving a pre-computed value, which is not the method of the present invention. Moreover, nowhere does Krishna reference even mention a second pass, or a first pass. Further, Krishna reference does not even mention a creation of miniplans and a simulated composite table, and it was stated in Office Action that it does not teach simulation.

Therefore, the reference cannot be used to reject these claims. Thus, dependent claims 5, 11, and 17 and all claims dependent upon them in the present invention recite novel and nonobvious structure and therefore distinguish over the cited prior art, Krishna, and are not obvious under 35 U.S.C. 103(a).

As per claim 6, 12 and 18 Office Action stated that Krishna teaches 'wherein the query being a SQL query as *an SQL query* [See col. 4, lines 38-40].

Cited section, starting at col. 4, lines 38-40, only shows an exemplary SQL query to be Considered as an example (col. 4, li. 42).

Therefore, the reference cannot be used to reject these claims. Thus, dependent claims 6, 12, and 18 and all claims dependent upon them in the present invention recite novel and nonobvious structure and therefore distinguish over the cited prior art, Krishna, and are not obvious under 35 U.S.C. 103(a).

Applicant notices with gratitude that the Office Action held that claims 3-4, 9-10, 15 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant has rewritten independent claims 1, 7 and 13, for clarification, and claims 3-4, 9-10, 15 and 16 should now be allowable.

Applicant notices with gratitude that the first Office Action held that Krishna fails to teach a combination of elements including wherein the first pass for each said miniplan storing a used table index, sorting data, and for each said least expensive join storing names of joined tables, and possible row orderings, as recited in dependent claims 3, 9 and 15.

However, the Final Office Action states the bolded sentence in an incorrect way and correction is thereby respectfully requested: "Claim 3 recites in specific details an unconventional query optimization approach at the lowest cost possible. Particularly, it requires that **a first pass for each miniplan store a used index table and a join method to then sort the data for each least expensive join names of joined tables**. One of ordinary skill in the art would not be able to derive the specific steps recited in claim 3 from the general propositions of claims 1 and 2. It should be noted that numerous approaches for optimizing queries have been suggested in the database art. Although the various approaches for optimizing queries have done so through minimizing the access path for minimizing query processing time, they do not necessarily keep track of the queries in the manner suggested by applicant as recited in claim 3. Therefore, even though the Krishna and Iyer references disclose sufficient limitations to **anticipate** claims 1 and 2, the specific limitations of claim 3 would not be readily ascertainable from such disclosure."

Further, Final Office Action Response to Arguments is also unclear. Not all Applicant's arguments with respect to claim 1-2, 7-8 and 13-14 are now moot in view of the new ground(s) of rejection because Applicant has amended claims 1, 7, and 13 to include a new limitation "using simulation". Final Office Action failed to address lack of miniplans, two pass method, and composite tables from the references although it was argued in the Amendment in regards to the Krishna reference and the same, incorrect argument was reused in the Final Office Action.

Regarding the independent claims' step (a) limitation "using simulation for determining an optimum join sequence", in the Specification and dependent claims **simulation** is specifically defined as **used for obtaining a simulated composite table and a set of miniplans for simulating all possible joins** and is not used in a vacuum, as in a cited dictionary.

Next, the Final Office states that: "Given the broadest claim interpreted, "creating a set of miniplans" as Sigma is defined as the sum of the number of tuples, wherein miniplans are "for simulating all possible joins" as a Sigma is used to pick from each join as it is performed in a join order among possible join orders (col. 3, lines 44-47)." Since this sentence grammatically incorrect it is interpreted that Sigma and a miniplan are, somehow, equivalents.

However, Krishna reference defines cardinality of a table as the number of records, in col. 1, li. 14 and sigma as a number of tuples estimated to result in each join, in col. 3, li. 46. Next, the reference calculates a sigma metric as a cardinality of each join by summing table cardinality estimates, preferably determined by a graph or retrieving a pre-computed value, as can be seen in col. 3, li. 46, li. 59-67. It merits the candidate join orders as a whole (Abstract) and not for partial miniplans. Cited col. 3-4 sections and Fig. 2 explicitly show obtainment of cardinality and calculation of sigma.

Present invention defines a **miniplan** in pages 6-7 of Specification as a control structure for adding a table to a composite table, for each step of a generated access path plan. It contains information such as: which table index to use, which join method to use, etc., and has nothing to do with number of tuples, cardinality and graphs. Therefore, sigma of Krishna has nothing to do with miniplans, simulation, two pass and composite tables of the present invention.

This confirms the Applicant's argument regarding the invalidity of 103 rejection of independent and dependent claims of the present invention, as shown above, because Krishna reference fails to teach use of the first and second pass, miniplans, composite tables and storing data for the least expensive join in the first pass, to be used in the second pass of the present invention.

Therefore, the Office Action itself admits that the Krishna reference cannot be used to reject these and independent claims of the present invention. Thus, independent claims 1, 7, and 13, as amended, and all claims dependent upon them in the present invention, including claims 3-4, 9-10, 15 and 16, recite novel and nonobvious structure and therefore distinguish over the cited prior art, Krishna, and are not anticipated by it under 35 U.S.C. 102(b) or obvious under 103(a).

Regarding claims 1-18, none of the cited references teaches, shows or suggests claimed subject of the present invention. Therefore, these reference cannot be used to invalidate independent claims 1, 7, and 13 and their dependent claims. Moreover, the Examiner quoted parts of sentences nonexistent in those references. However, even if these quotes are correct, the combination must be pointed to in the prior art itself and no such combination is pointed to in the cited references nor it could be since they perform differently. Therefore, these references cannot be used to invalidate independent claims 1, 7 and 13 and their dependent claims because they fail to teach any and all the steps of these claims.

Therefore, it is clear that the standard for establishing the prima facie case of obviousness under 103(a) has not been met for the claimed invention because each cited reference does not have any and all elements of independent claims, is from a completely different field, has different components, works in a different mode of use and produces different results. Improper combination of cited references is used in each claim rejection in the Office Action. None of the cited references suggests combination under *In re Sernaker*, 217 U.S.P.Q. 1, 6 (CAFC 1983), and one skilled in the art would have no reason to make a combination since they are from different fields, impossible to combine and individually complete. Moreover, none of the cited references discloses the subject matter and features of claims 1-18 of the present invention and even if they did show some individual features, they would not be able to meet the claims of the present invention which provide new and unexpected results over these references and are thus unobvious and patentable under Sec. 103.

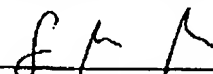
Thus, all submitted claims are allowable over the cited references and their reconsideration is respectfully requested. The prior art made of record and not relied upon is considered but found to be even less relevant than Krishna and Iyer references.

Therefore, all submitted claims are allowable over the cited reference and their reconsideration is respectfully requested. In view of the above, it is submitted that this application is now in good order for allowance, which applicant respectfully solicits. Should matters remain which the Examiner believes could be resolved in a telephone interview, the Examiner is kindly requested to telephone the Applicant's undersigned attorney. No additional fee is required in connection

with this communication since the Amendment is mailed within three months from the Office Action and the number of claims is not extending the original number of claims. However, any underpayment is authorized to be charged to Deposit Account Number 09-0460 in the name of IBM Corporation.

Respectfully submitted,

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